SD431.5
A23K3

TIMBER MANAGEMENT PLAN

WILLIAMS WORKING CIRCLE

KAIBAB NATIONAL FOREST

Region 3

Sixth Revision
(C.Y. 1956 through F.Y. 1966)

U. S. FOREST SERVICE

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Plans - Kaibab

TIMBER MANAGEMENT PLAN

WILLIAMS WORKING CIRCLE
KAIBAB NATIONAL FOREST

Region 3

Sixth Revision
(C.Y. 1956 through F.Y. 1966)
Approved: December 10, 1962

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UNITED STATES GOVERNMENT
MEMORANDUM

- Forest Service
Washington 25, D.C.

2410

TO : Regional Forester, R-3

Date: Dec 11 1962

FROM : Edward P. Cliff, Chief, By

Your Reference: 10/1

SUBJECT: Plans, R-3, Kaibab N.F., Williams W.C.

Enclosed are an approved copy of this plan and our review comments on it.

Enclosures

2xc: R-3

/s/ A.W. Greeley

UNITED STATES GOVERNMENT - Forest Service
MEMORANDUM Washington 25, D.C.

2410

TO : The Files Date: October 18, 1962

FROM : D.J. Morriss, Forester

SUBJECT: Plans, R-3, Kaibab N.F., Williams W.C.

This is a good practical plan.

The estimated cut, including cordwood thinnings, is 83% of the estimated periodic annual increment. However, the estimated sawtimber yield is about equivalent to the cut which would be indicated by the Von Mantel formula -- which is generally on the high side. Thus it is likely that the estimates are fairly close to what may be expected under the prescribed area regulation.

In the plan an administrative working group is set up but neither its size, nor locations, are known or shown. The rotation for these Category 3 areas is 200 years which exceeds the 160 year maximum suggested in FSH 2413.15a. However, for such poor sites changes within the range of 100 to 200 years are relatively unimportant from a total yield standpoint.

Approval is recommended.

/s/ D.J. Morriss

3cc: R-3

Forest Service, Region 3
Albuquerque, New Mexico

Chief

2410
October 1, 1962

Fred H. Kennedy, Regional Forester

Plans

We are sending for your review and approval, two copies of the Timber Management Plan for the Williams Working Circle of the Kaibab National Forest. Because the accompanying maps are quite bulky, they are bound in one separate binder for each copy of the plan. This arrangement will facilitate our making corrections to the maps, as needed.

We recommend your approval of this plan.

Enclosures

2 cc: Forest Supervisor, Kaibab

Forest Service, Region 3
Albuquerque, New Mexico 2410

Regional Forester September 14, 1962

Dahl J. Kirkpatrick, Chief, Division of Timber Management

Plans (Kaibab; Williams Working Circle)

Subsequent to our discussion concerning the Williams Working Circle Timber Management Plan (Sixth Revision), I have again reviewed the document and have made the following changes in it, which I think take care of the points which we agreed were in need of adjustment.

1. The appendix material copied from the Multiple-Use Plans for the concerned Ranger Districts, dealing with roadside zones, waterfront zones and recreational areas, has been removed.

2. On Page 5, a stronger reference to the Ranger District Multiple-Use Plans has been included under "G. Coordination With Other Uses" as a substitute for the foregoing.

3. Adjustments have been made throughout the plan to eliminate the restrictive acreage limits on compartments. The guide as to acreage now says "1,000 to 5,000 acres," but indicates that larger compartments will be permissible in timber fringe-types or outside of the commercial-timber zone.

4. The desirability of using range fences or other range management sub-divisions as compartment boundaries where feasible as an aid to management correlation is suggested. (Page 17, VI., B., 2. Compartments).

The revised plan is enclosed for your review and approval.

Enclosures
(2 copies of plan)

/s/ Dahl J. Kirkpatrick

SIXTH REVISION - 1962

TIMBER MANAGEMENT PLAN

WILLIAMS WORKING CIRCLE

KAIBAB NATIONAL FOREST

REGION 3

1962

Prepared by:

/s/ Jim D. Hodge

/s/ Homer W. Moody

/s/ Robert L. Diggs March 26, 1962

Approved by:

/s/ F.M. Hodgin March 27, 1962
Forest Supervisor

/s/ Fred H. Kennedy Sept 25, 1962
Regional Forester

/s/ A.W. Greeley Dec. 10, 1962
Acting Chief

/s/ DJK

Reviewed by:

Regional Office		Divisions	Washington Office	
Initials	Date		Initials	Date
/s/ DJK	6/28/62	Timber Management		
/s/ DFR RN	6/28/62	Engineering		
/s/ LGW	4/4/62	Multiple Use		

I. CONTENTS

	Page No.
TITLE PAGE	A
APPROVAL PAGE	B
CONTENTS	C-D
LIST OF TABLES	D-E
LOCATION MAP OF WORKING CIRCLE	F

II. SUMMARY OF PLAN
- A. Management Objectives for the Working Circle
- B. Area and Volume Summaries
  - 1. Ownership Status
  - 2. Commercial Forest Lands - National Forest Only
  - 3. Noncommercial Forest Lands - National Forest Only
  - 4. Aspen
- C. Growth
  - 1. Periodic Annual Growth
  - 2. Potential Mean Annual Increment
- D. Regulation
- E. Allowable Cut and Cutting Limitations
  - 1. Available Cut for Planned Period - 1/1/1956-6/30/1976
  - 2. Cutting Limitations
- F. Plan Revision
- G. Coordination With Other Uses

III. INTRODUCTION
- A. Description of Working Circle
- B. Description of Timber
- C. History of Working Circle
- D. Past Accomplishments

IV. PROBLEMS
- A. Timber Harvest
- B. Timber Utilization
- C. Animals
- D. Logging Camps

V. MANAGEMENT PRESCRIPTIONS
- A. Silvicultural System
- B. Rotations
- C. Methods of Cutting
  - 1. Intermediate Cutting
  - 2. Reproduction Cutting
- D. Stand Priorities
- E. Special Treatments
  - 1. Recreation Areas
  - 2. Wildlife

F. Precommercial Thinning and Noncommercial Release Cutting
G. Commercial Thinning and Pulpwood Cutting
H. Cutting of Other Products

ACTION PLAN - Sections VI, VII, VIII, and Maps

VI. MANAGEMENT CONTROLS
A. Inventories
B. Division of Working Circle and Compartment Examination
C. Regeneration Controls
D. Calculation of Planned Cut
E. Marking Rules
F. Records
G. Cutting Budget

VII. TIMBER DISPOSAL POLICIES
A. Sales
B. Point of Manufacture
C. Utilization Standards

VIII. FOREST DEVELOPMENT
A. Transportation
B. Reforestation
C. Timber Stand Improvement
D. Fire Control
E. Rodent Control
F. Animal Control

IX. INSECT AND DISEASE CONTROL
A. General Conditions
B. Special Problems
1. Diseases - Dwarfmistletoe
2. Tree Killing Bark Beetles
C. Handling Abnormal Conditions

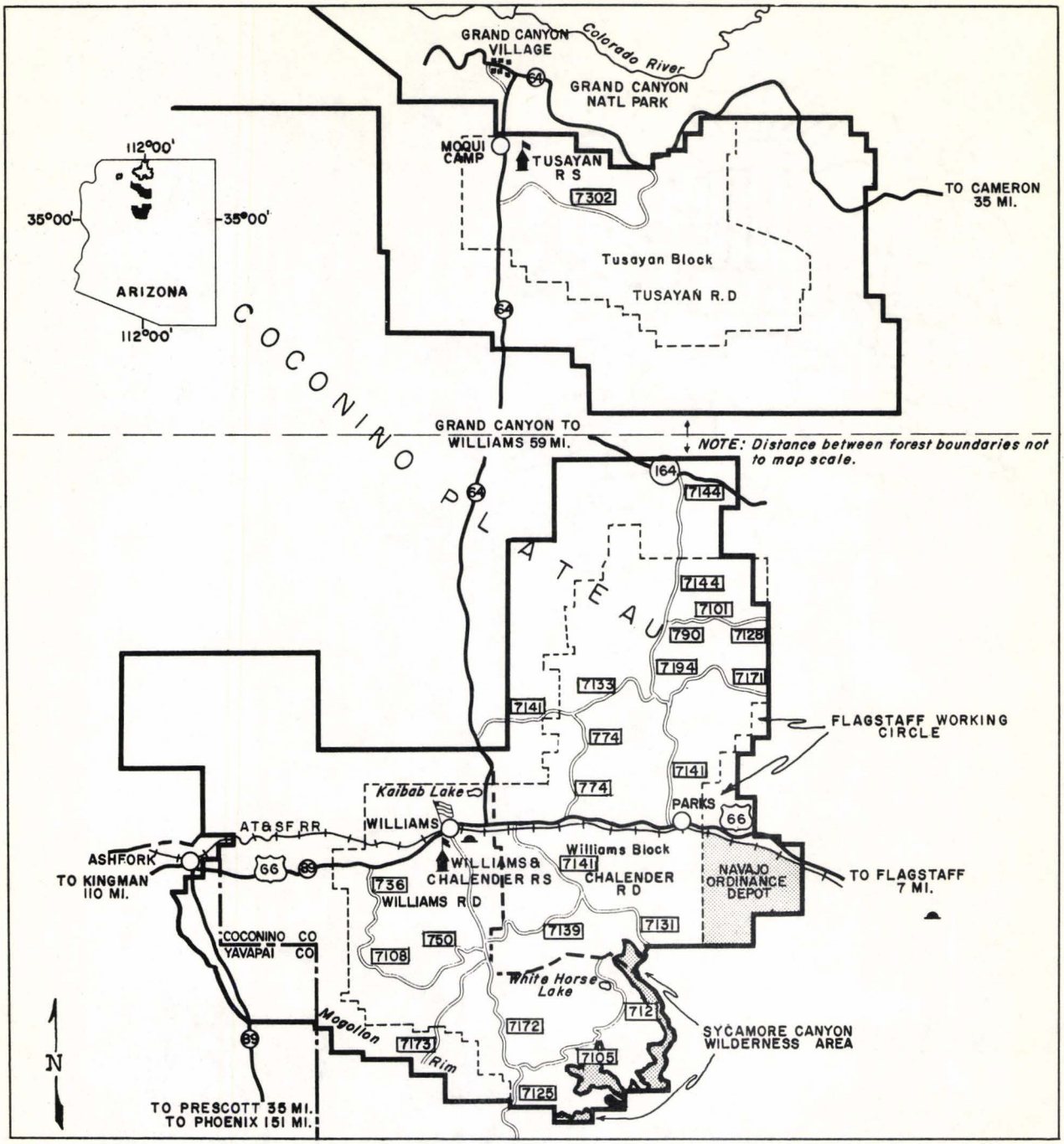
X. APPENDIX - Index

LIST OF TABLES

Page No.

Table 1. Ownership Status
Table 2. Commercial Forest Lands - National Forest Only
Table 3. Noncommercial Forest Lands - National Forest Only
Table 4. Aspen
Table 5. Periodic Annual Growth
Table 6. Potential Mean Annual Growth
Table 7. Sawtimber Cutting Budget
Table 8. Pulpwood Cutting Budget
Table 9. Road Construction Budget

		Page No.
Table 8.	Pulpwood Cutting Budget	20
Table 9.	Road Construction Budget	22a, b, c
Table 10.	Planting and Seeding Budget	23
Table 11.	Thinning Program Budget	24
Table 12.	Gross Land Ownership	33
Table 13.	Classification of Land Area	34
Table 14.	Classification of Commercial Forest Lands and General Condition Classes	35
Table 15.	Net Volume by Species - All Lands	36
Table 16.	Net Volume by Species - National Forest	37
Table 17.	Net Volume by Sawtimber Types - All Lands	38
Table 18.	Net Volume by Sawtimber Types - Nat'l. Forest	39
Table 19.	Gross Volume Per Acre by Species, Types and Density Classes	40
Table 20.	Defect Factors	41
Table 21.	Stand Table - P1-C	44a
Table 22.	Total Volume Plot Summary - By Types	44b
Table 23.	Record of Cutting 1949-1955, Inclusive	49
Table 24.	Record of Cutting 1956-1961, Inclusive	50
Table 24a.	Cutting Budget Actual Cut	51
Table 25.	Fire Record 1953-1961, Inclusive	52
Table 26.	Compartment Examination Budget	53



LOCATION MAP

WILLIAMS WORKING CIRCLE

KAIBAB NATIONAL FOREST

R—3

1 0 2 4 6 8 10

SCALE

LEGEND

- Forest boundary
- Ranger district boundary (coincides with block boundary)
- County line
- Working circle boundary
- Supervisor's headquarters
- Ranger station

Working circle and forest boundaries coincide unless otherwise shown

- 66 — Federal
- 89 — State
- 761 — Forest
- ROADS
- Railroad
- Mfg. facilities

II. SUMMARY OF PLAN

A. Management Objectives for the Working Circle

1. Even-aged management will be applied. Conversion from the all-aged management practiced in the past will be made as rapidly as feasible.

2. A balance of 20-year age classes will be attained by area. At least one full rotation period will be required. A major adjustment can be achieved over the next 60 years.

3. Proper stocking will be attained on all commercial acres through planting and seeding of nonstocked and poorly stocked areas and through thinning and cutting of other stands.

4. Maximum mean average growth and yield per acre will be attained through the application of silvicultural and mechanical practices.

5. Maximum quality products will be grown by improving stands with intermediate cuts, selective regeneration, and with artificial stand improvement measures.

6. An adequate road system will be developed for timber harvest, recreation, and wildlife use.

7. The timber will be developed and utilized fully as a leading demonstration of multiple-use management.

8. The Working Circle will be divided into compartments varying in size from approximately 1,000 acres to 5,000 acres. Examination of each compartment will be made and an appropriate prescription for management of the compartment will be written.

9. Utilization of the timber will be concentrated in established communities.

10. Maximum support to nearby communities will be furnished by promoting the installation of an integrated forest products industry in Williams and by harvesting the full allowable cut.

11. Nonproducing trees in the remaining virgin stands will be harvested to place these stands in a productive condition.

12. Pulpwood and poles will be harvested on a planned basis.

B. Area and Volume Summaries

1. Ownership Status

Table 1.

Ownership Class	All Lands Acres	Commercial Forest Lands Acres	Commercial Forest Lands Net Volume Mbf. Scribner
National Forest	387,199	298,643	715,897
State	640	575	1,380
Private	33,588	11,816	18,422
Total	421,427	311,034	735,699

2. Commercial Forest Lands - National Forest Only

Table 2.

Sawtimber 11.6" +

Condition Class	Acres	Net Volumes Scribner Mbf.
Virgin Sawtimber	22,968	68,196
Cutover Sawtimber	248,258	647,386
Nonstocked	26,932	-
Aspen	325	-
Administrative Areas	160	315
Total, Commercial	298,643	715,897

3. Other Forest Lands - National Forest Only

Table 3.

Land Class or Condition Class	Acres	Sawtimber 11.6" + Net Volumes Scribner Mbf.
Sawtimber-Inoperable	5,220	21,766
Woodland	53,085	-
Brush & Grassland	30,251	-
Total, Other Forest Lands	88,556	21,766
Total, Working Circle	387,199	737,663

4. Aspen

Table 4.

Condition Class	National Forest Net Volumes Cu. Ft.	Private Net Volumes Cu. Ft.	Total Net Volumes Cu. Ft.
Aspen	45,143	10,070	55,213

C. Growth

1. Periodic Annual Growth

Table 5.

Timber Type	Total Scribner MM Bd. Ft.	Per Acre Scribner Bd. Ft.
Ponderosa Pine	26.159	88.5
Mixed-conifer & spruce-fir	.227	88.5
Total, Working Circle	26.386	

2. Potential Mean Annual Increment

Table 6.

Timber Type	Total Scribner MM Bd. Ft.	Per Acre Scribner Bd.Ft.
Ponderosa Pine	35.766	121
Mixed-conifer & spruce-fir	.360	140
Total, Working Circle	36.126	

D. Regulation

	Technical Working Group	Administrative Working Group
1. Control	By Area	By area except by individual tree on recreation sites
2. Cutting Period -		
Sawtimber	20 years	20 years
Pulpwood	10 years	10 years
3. Rotation Age	110 years	190 years
4. Rotation Period	120 years	200 years

E. Allowable Cut and Cutting Limitations

1. Available Cut for Planned Period - January 1, 1956 - June 30, 1976.

For Period July 1, 1962-June 30, 1976

	Annual Cut	Period Cut	Per Acre
Sawtimber, Scribner	12,000 Mbf	168,000 Mbf	1 Mbf / 1
Pulpwood	20,000 cords	(To be appended when inventory is completed)	/ 2

/ 1 Based on 168,000 suitable, stocked acres
/ 2 Based on (*) suitable, stocked acres
* To be furnished when inventory is completed

The allowable cut for the period January 1, 1956 through December 31, 1961 was established at 7,200 Mbf Scribner. This cut was established tentatively in the original draft of the plan for this cutting period. Actual cut during this time period has been 45,317 Mbf Scribner.

This plan will operate and terminate now on a fiscal year basis. The conversion period from calendar year to fiscal year will be from January 1, 1962 through June 30, 1962. The available cut for this period is 6,000 Mbf Scribner.

Total actual and planned sawtimber harvest for this cutting period is summarized as:

January 1, 1956 through December 31, 1961	- 45,317
January 1, 1962 through June 30, 1962	- 6,000
July 1, 1962 through June 30, 1976	-168,000
Total	219,317 Mbf Scribner

2. Cutting Limitations

A sufficient number of compartments will be entered each year to provide a sawtimber harvest and subsequent silvicultural treatment of approximately 15,000 acres of the commercial timberland. In addition, compartments comprising approximately 30,000 acres will be entered annually with the pulpwood harvest.

Compartment examination and prescription will in all cases precede cutting and treatment by 3 years as quickly as it is possible to get the Working Circle compartmentized and the examinations scheduled.

Each timber stand will be cut to the basal area control for the site index and age of that stand. It is expected that the annual yield will be a minimum of 12,000 Mbf Scribner. Cutting will be controlled by area and stand basal area. Undercuts may be made up at any time in the cutting period.

F. Plan Revision

This plan will be revised by June 30, 1966. Amendments to the plan or complete revision of the plan may be made following: major changes in land status; major losses of timber from fire, insects, disease, or windthrow; major changes in utilization; or any other major change which affects this plan. Compartment data will be appended as it is developed. The Forest Supervisor has the authority to make changes in the budget of entry. Action plans - Sections VI, VII, VIII, and Maps - will be revised annually, as needed, by the Forest Supervisor for approval by the Regional Forester.

G. Coordination With Other Uses

Although this Timber Management Plan makes reference to the need for special treatment of areas classified for other uses and establishes a separate working group for recreation areas, roadside areas, stream-front zones, etc., the Multiple-Use Plans for the Ranger Districts outline the multiple-use decisions that have been made for the management of all resources and state the coordinating requirements. The Ranger District Multiple-Use Plan will therefore be the guide for coordinating timber use with other uses in the development of detailed timber management prescriptions for the administrative working group.

III. INTRODUCTION

A. Description of Working Circle

The Williams Working Circle embraces the entire sawtimber type within the Williams and Grand Canyon Divisions of the Kaibab National Forest. It includes parts of the Williams, Chalender, and Tusayan Ranger Districts. The Working Circle is located at the west edge of the Colorado Plateau and includes the timbered area logically tributary to the Town of Williams, shipping point on the main line of the Santa Fe Railroad. The Circle is bounded on the east by the Flagstaff Working Circle and the Navajo Ordnance Depot; on the north by the Grand Canyon National Park; and on the west and south by the edge of the type.

There are a few minor areas of pinyon-juniper type included within the Williams Working Circle boundary. Cutting in the woodland type is not regulated.

Most of the timbered area within the Circle is now National Forest. There is considerable acreage of privately-owned land which consists mainly of widely scattered tracts patented under the Homestead Law, particularly the Act of June 11, 1906. These areas are largely nontimbered. The timbered and alienations which still exist are being eliminated gradually and returned to Government ownership through land exchanges. Alienated lands within the Working Circle include one section of State University land.

The Working Circle is now largely cut over. The bulk of the virgin timber has been removed.

On the Working Circle there are 26,932 acres of nonstocked commercial forest land. All commercial sawtimber types on the Williams Block, except nonstocked, contain appreciable volumes of subsawlog trees which will be available for pulpwood harvest. The stands on the Tusayan Block are deficient in the subsawlog size classes. Thus, the major portion of the pulpwood yield for the Working Circle will come from the Williams Block.

The topography is typical of the Colorado Plateau, the Working Circle being situated near its western end. Geologically, the Plateau is of recent origin and water courses have not as yet cut deep canyons. Consequently, the area is relatively level and easily accessible. It is broken only by a few volcanic cones, the larger ones being Sitgreaves, Bill Williams, and Kendrick Mountain. There are also a number of small cones. Only the three larger mountains cover extensive areas. Much of the timber on them is inaccessible and their presence has an influence on the location of transportation routes. Generally, the soil on the Williams Division is malpais in character with considerable loose surface rock and outcroppings. As a whole, the topography is such that the area is readily accessible to logging equipment. Roughly, the south half of the Williams Block drains into the Verde River. The balance of this Block and the entire Tusayan Block drain into the Colorado River.

The soil falls into two broad classes. On the Tusayan Block, it is the residual portion of the weathered Kaibab limestone. On the Williams Block, it is basalt for the most part. Soils on the Tusayan Block are light, take up moisture readily, give it up easily, and are naturally dry. Consequently, establishment of pine reproduction is difficult. Those on the Williams Block are adobe in character, heavy, and take up moisture slowly. They are reasonably favorable for reproduction. On portions

where the heavy soil contains a considerable amount of volcanic cinders, natural reproduction becomes established without difficulty.

B. Description of Timber

1. Tusayan Block

a. Virgin Timber

The remaining virgin timber is in stands that are below the average quality as compared with other Colorado Plateau timber. The average volume per acre is low, averaging about 3,400 board feet per acre. It seldom reaches more than 7,000 feet per acre, even on small areas. The timber is relatively short. Mature trees usually average three and four logs per tree. Being more or less open grown, the timber is rough with large limbs and heavy defect.

Consisting mostly of fringe type, these virgin remnants largely occupy the lower elevations on dry sites just above and in the transition zone where the pine and pinyon-juniper types merge. Pine gives way to pinyon-juniper woodland at approximately 6,500 to 6,900 feet. However, there is considerable extension of the pine type, consisting of small "stringers" of timber, out onto the more mesophytic sites in the woodlands. Natural reproduction is entirely lacking. Exposed soils erode easily. Care must be exercised to preserve the forest cover.

b. Cut-over Timber

The old cutover area on the Tusayan Block supports a relatively scattered residual stand of intermediate and mature timber. This area was cut by the Saginaw and Manistee Lumber Company between 1928 and 1938. Cutting was much too heavy. The cut-over cruise figures and timber sale cutting records indicate that between 75% and 80% of the merchantable volume was cut. Over the old cut area, poles and blackjacks are distinctly lacking although there is a reasonably good stocking of seedlings and small sapling growth.

2. Williams Block

a. Virgin Remnants

The virgin fringe is composed mostly of scattered mature trees with some intermediates and blackjacks. In some places, there is a fair stand of young growth, but, on most of the area, reproduction is very scattered or entirely lacking. On some of the area, saw-timber is too scattered to permit cutting.

Douglas-fir occurs in mixture with pine in a few places adjacent

to higher inaccessible areas. Some wind shake, pitch scars, and mistletoe is encountered in the larger trees.

White fir also is found in mixture with pine and Douglas-Fir adjoining the higher inaccessible areas. This species is very rotten where diameters exceed thirty inches. The younger trees, under twenty-four inches, are reasonably sound.

Aspen occurs on some of the moist sites and on north slopes. A few small areas support pure stands. The quality in some of these pure stands at higher elevations is very good.

b. Cut-over Timber

The Williams Block contains the balance of the cutover area in the Working Circle. On most of the preforest and timber rights clearcut sections, there is a dense stand of poles and small blackjacks with volumes running from 1,000 to 1,500 bd. ft. per acre. On the balance of the cutover area from 20 to 80% of the volume has been retained and stands now average 3,400 bd. ft. per acre. The area, as a whole, is well stocked. There is young growth in the seedling, sapling, and pole classes.

Large areas, on the Circle within the sawtimber type, are open grasslands known locally as parks and prairies. Some are relatively large. Nearly all have varying amounts of pine reproduction on them, particularly along the edges. Many now have sufficient reproduction to warrant classification as timber type. The area of the sawtimber type is increasing to a certain extent.

C. History of Working Circle

The first timber cutting within the Williams Working Circle began with the construction of the Atlantic and Pacific (now A.T.&S.F.) railroad. The Act of March 3, 1887, granted all odd numbered sections within a strip forty miles wide on each side of the right-of-way to the A. & P. railroad. Through various transactions nearly all of the granted lands were reconveyed but with the right to cut the virgin timber reserved by the Saginaw and Manistee Lumber Company until 1950.

With the erection of a railroad station, yard, and roundhouse, the Town of Williams was incorporated in 1891. The Saginaw and Manistee Lumber Company mill, designed to cut about 25,000 M per year, was erected, and heavy cutting started about 1893.

The Saginaw cutting was by means of a railroad operation. Methods of cutting have varied extensively. Dating back to preforest cutting, certain areas were cut only for ties. Large areas, including a major portion of the timber rights, were clear cut. Some of the later timber rights cutting was under a Seed-Tree

Agreement in which some 15% of the merchantable timber was retained. Areas cut under National Forest timber sales were selectively cut but, for the most part, only 20 to 25% of the merchantable volume was retained. During the period from 1937 to 1949, the volume selected for cutting has been progressively lighter, until in recent sales it has been held between 20 to 40% depending on the character of the stand. As a result, the area presents a very helter-skelter pattern with no uniformity over any very large area.

A considerable portion of the easily accessible timberland was cutover prior to 1900. By 1941, when the large mill was dismantled, nearly all of the timbered area was cutover. All merchantable timber was harvested from the timber right sections (every other section) and most National Forest Sections were cut 75-80 percent. Two small mills with a combined annual cut of less than three million board feet were all that remained of the industry for a number of years after 1941.

A considerable area of the Working Circle is in the form of widely scattered small private holdings. Most of these originated under homestead acts. There was a big influx of settlers onto these tracts starting about 1914 and continuing on through the early twenties. The submarginal character of the land eventually forced most settlers to leave and the present population is largely concentrated in a few communities where the most productive land is located. At best, income from the small dry farms is low. With the exception of stock raising, local employment is very limited and it is very unlikely that there will be any appreciable increase in population in the small communities. The economy of Williams at present is based largely on tourist industries and stock raising but timber is about of equal importance and will contribute to an increasing extent as time goes on.

Dependency for sawtimber is almost entirely on the National Forest supply supplemented in small amounts from alienated lands within and adjacent to the Working Circle. The supply from these latter sources is practically exhausted and henceforth dependency will be almost 100% on National Forest Timber.

A small but modern finishing plant is operated in conjunction with the saw mill.

The first management plan for the Williams Working Circle was made by J. H. Allison and A. B. Recknagel in 1911. This plan was revised first by H. H. Chapman in 1919, then by Quincy Randles in 1923, and again by D. M. Lang in 1927. In 1937, the plan was again revised by Robert C. Salton to cover the decade 1937-1946, and in 1949 by E. C. Groesbeck for the decade 1949-1958, inclusive.

Since the plan was last revised several important changes have taken place. Modern logging methods have made it possible economically to log scattered areas from which only a small volume (1 M or less per acre) is removed. Some areas, heretofore considered inaccessible, can be logged successfully now. The limits of the Working Circle have been changed by exclusion of the Navajo Ordnance Depot area. A considerable area lying generally east of Government Prairie and Kendrick Mountain has been excluded and thrown in with the Flagstaff Working Circle. This reduced the acreage 44,611 acres to a total of 387,199.

Other changes in acreage calculations were: (1), reserved areas including recreation zones and sites were moved into commercial forest area; (2), much of the inoperable area is included as operable. Because of differences in mapping techniques and differences in recording data, it is not possible now to determine the exact acreage which has been charged above from the last plan.

D. Past Accomplishments

1. Volume and Area Cutover

The inventory for the previous plan was developed from cruise and sale area data. This was made in 1948. The total volume on the area, estimated at that time, was 575,930 Mbf. This included operable, inoperable, and reserved areas. The new inventory, made 8 years later, in 1955, estimated 737,663 Mbf.

During the period 1949 to 1958 cutting was accomplished on 41,670 acres with a harvest of 54,478 Mbf.

2. Timber Stand Improvement

Timber stand improvement beginning in 1949 was limited to pruning, with some release of pruned trees. This was done with available K.V. funds. Year ending Dec. 31, 1961, 240,136 trees have been pruned on 27,255 acres. In addition to this, during the years 1934 to 1941 the C.C.C. program pruned trees in 6,840 acres. No records of the number of trees pruned are at hand.

3. Planting and Seeding

Special measures were not taken to provide stocking in nonstocked areas. Regeneration was dependent on natural seeding.

4. Fire Control

Fire protection has been effective. Approximately 200 acres have been denuded by fires during the last 20-year period.

5. Management

In Gross' memorandum of Dec. 21, 1949, received with the approved copy of the 1949 plan, it is recommended that compartmentization and area regulation be considered as a means of management for this Working Circle. This was not developed initially during the plan period but is being adopted now for this period.

IV. PROBLEMS

A. Timber Harvest

The major problem in harvesting lies in getting access roads into timber areas. Due to low volumes per acre the timber cannot support construction of roads to Forest Service standards. Many existing roads are also in need of restoration and relocation.

B. Timber Utilization

The present stand of timber on the Williams Working Circle contains a substantial number of stems that are too rough to be utilized for pulp or sawtimber. Disposition of these stems will be made so as to put the stands in proper silvicultural condition. The present plan is for disposition by poisoning.

C. Animals

Sheep and cattle, and in some areas deer, present a problem to establishment of reproduction due to browsing. Areas to be reforested must be enclosed or deferred from grazing for a period of time that allows the reproduction to grow beyond the browsing stage.

Rodents are significant deterrents to securing regeneration by either natural or direct seeding. Poisoned oats are now being used to rid the direct seeding area of rodents.

D. Logging Camps

Location of mills in the woods on this Working Circle is not satisfactory.

Lack of an adequate supply of water in the woods, inaccessibility to schools, and general unsatisfactory living conditions make small woods camps unsatisfactory. At best, such camps can only be occupied seasonally, as winter snows shut down logging operations and individuals living in woods camps are obliged to move. As a general rule, loggers travel to and from the woods each day from nearby towns and settlements. This arrangement is believed to be the most satisfactory and will be encouraged.

V. MANAGEMENT PRESCRIPTIONS

There are two working groups to consider: (1) Technical working group which consists of the commercial forest area primarily used to produce timber and (2) the Administrative working group including recreation sites, recreation zones and administrative areas where cutting is permitted or needed. Areas of these groups have not been determined but will be necessary to apply the planned systems.

A. Silvicultural System

The silvicultural system will be seed tree or shelterwood. The objective is to convert from the all-aged management used in the past to even-aged management as rapidly as possible. Even-aged management will use area regulation compartmentization, compartment examination, silvicultural prescriptions, and typing by age classes. This will be the initial effort toward organization of the Working Circle into equal areas by age classes as determined by the number of cutting periods in the rotation.

Group and individual tree selection will be used in the administrative working group.

B. Rotations

Rotation age is presently established at 110 years with an allowance of 10 years for regeneration making a rotation period of 120 years for the technical working group. This may be lengthened or shortened as more accurate site information is gathered.

Rotation period for the administrative working group will be 200 years.

C. Methods of Cutting

The methods of cutting are grouped broadly into the two main classes, intermediate cutting and reproduction cutting (Ref. FSH 2411.11).

1. Intermediate Cutting

Intermediate cutting consists of repeated periodic cuts which remove and utilize a portion of the stand. Intermediate cuts will include one or more of the following at each entry:

a. Thinning cut to improve growth rate in the residual stand.

b. Improvement cut to remove less desirable species, trees of poor form, and trees of poor genetic qualities.

c. Sanitation cut to remove trees infected with disease or infested by insects.

d. Risk cut to remove trees likely to die before the next periodic cut. (This will include first entry into virgin stands)

e. Salvage cut to remove merchantable dead or dying trees.

2. Reproduction Cutting

Prompt and satisfactory establishment of reproduction is essential to successful timber management. This can be accomplished naturally in stands by use of the seed tree method of cutting (leaving approximately 10 seed-producing trees per acre) in stands that have been set up for regeneration. This is usually accomplished as follows:

a. Preparation cut to remove the trees necessary to reduce the stand to the number of seed trees needed to reproduce the area and to provide openings for regeneration.

b. Removal cut to remove seed trees after establishment of regeneration, or failing to get natural regeneration, removal before artificial regeneration.

D. Stand Priorities

Stand priorities for cutting should be established in accordance with silvicultural factors and utilization principles. These should be decided by managers on current knowledge of ground conditions, markets, etc. Generally, stands having a high mortality rate, large quantities of poor quality trees, a shortage of regeneration, or those having excessive density should be entered in the order given.

E. Special Treatments

1. Recreation Areas

These areas will be managed under the administrative working group. Silvicultural prescriptions will follow the guidelines which are detailed in the Forest Service Handbook 2413.15a. Timber will be managed to maintain a suitable tree

cover in these areas. The 1/4 mile strip which borders the Grand Canyon National Park will be included in the administrative working group. All slash in this strip will be piled and burned.

2. Wildlife

Wildlife habitat needs will be considered in the prescription for each compartment and timber sale. Guidelines are detailed in Forest Service Handbook 2413.15c.

E. Precommercial Cleaning and Noncommercial Thinning and Release Cutting

A large portion of the Working Circle is in need of precommercial thinning to reduce stand density to that compatible with maximum growth in relation to site index. Forest guides will be prepared. This program has been initiated. The 10-year program is shown in Section VIII, C.

G. Commercial Thinning and Pulpwood Cutting

The primary objective of commercial thinning is to reduce the stand density by utilizing cut material for forest products and by leaving a residual stand basal area which is determined to be optimum for its site index and age class.

At present, the Williams Block of the Working Circle is under contract to provide wood for the new pulpwood mill at Snowflake, Arizona. A cruise, to locate stands for entry and merchantable volumes, is nearing completion. It is estimated that approximately 250,000 cords are available for immediate harvest. Under management and proper organization of age classes the yield in small products (11.6" DBH and below) should approach the mean annual increment for sawtimber as determined by present yield tables. This yield will be in addition to that for sawtimber.

Stands which need thinning should be entered as the market develops. Little can be gained by reserving pulpwood volume since eventually some will grow into sawlog sizes and others will be lost through mortality. Emphasis should be on regeneration and silvicultural treatment to produce the necessary quantities of wood for the contract.

After cutting progresses, a firm estimate based on historical data, can be developed for the pulpwood annual yield.

H. Cutting of Other Products

With the addition of a gang saw at the local sawmill to utilize the sawlogs, 11.6" DBH and larger, together with the pulp market, a complete job of utilization can be accomplished. Poles may be available for the Prescott treating plant. The only additional material would be posts in the subpulpwood size classes or aspen products, should this not be used by the pulp mill.

Areas, that can be used for the production of Christmas trees as well as for the production of pulpwood and sawtimber, will be located and designated during compartment examination. Christmas trees will be grown on these areas in conjunction with the other timber. When all potential Christmas tree production areas have been determined, an annual production and harvest budget will be prepared and appended to this plan. The objective will be to attempt to satisfy the local increasing demand for this product.

ACTION PLAN

1962 Timber Management Plan

Williams Working Circle

Kaibab National Forest

Sections VI, VII, VIII, and Maps

Review and Revision Control Schedule

Fiscal Year	Forest Supervisor						Regional Forester	
	Reviewed By:		Revised by:		No Revision Needed		Approved by:	
	Name	Date	Name	Date	Name	Date	Name	Date
1962	Working Circle Plan Prepared by: Robert L. Diggs, March 26, 1962							
1963								
1964								
1965								
1966								

Revised Working Circle Plan Prepared by: _____

Date: _____

VI. MANAGEMENT CONTROLS

A. Inventories

In 1955, a timber type map was prepared from aerial photo interpretations supplemented by ground checks and a timber inventory based on 425 randomly located 1/4 acre plots was made. This inventory was done by a crew of technically trained foresters under the supervision of Professor Ray Moore of Utah State College. The statistical reliability of the volume estimates is ± 6.046 percent (two times out of three).

The Working Circle will be reinventoried in 1965. Growth data will be obtained and stands will be reclassified by site index, age, and basal area density.

B. Division of Working Circle and Compartment Examination

1. Blocks

The geographical isolation of the two timbered areas, one near the Grand Canyon and the other surrounding the Town of Williams, together with the marked difference in the character of the timber stands in the two areas, renders the division of the Working Circle into two Blocks desirable for geographical identification, cutting budget purposes, and administrative control. Growth calculations are on the Circle as a whole. The Blocks have been designated Tusayan and Williams. With the imminent completion of the initial harvest of the virgin timber on the Bull Basin Block, the need for the maintenance of this area as a separate management sub-division has dissipated, and it has been combined with and will be managed as a part of the Williams Block.

2. Compartments

The Blocks will be divided into compartments. One division has already been made for the pulpwood inventory, but, as a whole, the compartments are too large. Compartments should be approximately one thousand acres in size but not larger than five thousand acres. Boundaries should be topographic or man-made features. Compartments will fit into logical logging units and insofar as feasible from a timber management point of view will utilize range fences or range management subdivisions to facilitate use coordination. The entire area of the working circle will be compartmentized as soon as possible. Areas in fringe types or outside of the commercial timber zone may exceed the size limits indicated above.

These compartments should be examined, using photographs, before entering for sales or cultural treatment. The stands should be delineated into age classes, or non-stocked area, and the proper silvicultural treatment

prescribed. Eventually, compartment examination should be accomplished two years before entry.

C. Regeneration Controls. (Ref. FSH 2460)

Regeneration is one of the prime necessities of forest management. Since problems are present in protection from wildlife, domestic animals, and biotic agents, the manager should follow these guides:

1. Plans for regeneration controls should be made at least three years in advance of cutting. The regeneration area should be outlined on a compartment map and treatment prescribed to establish regeneration. The location of the area should be given to the Supervisor at least three years before regeneration activities. In coordination with other uses, the Forest Supervisor will establish adequate protection measures for the regeneration areas. Measures for protection from grazing by domestic stock, wildlife, and rodents will be provided. This protection will be continued until reproduction has become established above browse height. Guidelines are provided in FSH 2474.5.

   Once the treatment is accomplished, annual checks will determine the need for further treatment and protection.

2. Once the area is declared regenerated the area should be placed on an Atlas as a 0-20 year age class.

D. Calculation of Planned Cut

Area regulation will be used to control the cut. The cutting period is established at 20 years for sawtimber. This means that 1/20 of the area should be classified to be cut annually. The stands will be treated silviculturally. Area can be adjusted to utilize approximately the same volume annually. As historical records are developed for each five-year period, the allowable cut can be adjusted by experience.

At present, the allowable cut is estimated at 12,000 Mbf annually. Calculations are in the Appendix.

E. Marking Rules

Marking rules will be developed from regional guides, site indexes, and experience. They will be furnished to timber markers to accomplish the objectives of the plan.

F. Records

Records will be kept in accordance with regional standards. Treatments should be recorded so that at the next revision accomplishments can be noted.

G. Cutting Budget

(See page 19a and b)

Table #7

CUTTING BUDGET - PLANNED

Districts - Sale — Commercial Forest Land - Acres and Volume to be Cut

Map Ref	Chalender Wms Blk	Acres	MM Bd.ft	Fiscal Year: Mbf. 1963	Mbf. 1964	Mbf. 1965	Mbf. 1966	Mbf. 1967	Mbf. 1968	Mbf. 1969	Mbf. 1970	Mbf. 1971	Mbf. 1972
1.	Dogtown	7200	7.0	4000									
2.	So. Sitgr.	3200	3.5	3500									
3.	Volunteer	5000	5.0		5000								
4.	No. Sitgr.	3200	3.5			3500							
5.	Rosilda	9500	10.0			500	4500	4000	1000				
6.	K'A' Hill	6500	6.5						3000	3500			
7.	Chalender	5000	2.5							500	2000		
8.	Pipelines	9000	9.0								2500	4500	2000
9.	Govt. Mtn.	9000	12.0										2500
10.	Bull Basin	7500	8.0										
Sub-Totals		65100	67.0	7500	5000	4000	4500	4000	4000	4000	4500	4500	4500
Williams - Wms. Blk.													
1.	Pozzoulana	6400	7.0	2000	5000								
2.	Bixler	5000	5.0			5000							
3.	Andrews Spr	5000	5.0				5000						
4.	Bear Spr.	5500	5.5					5500					
5.	Lockett	5500	5.5						5500				
6.	Adams	5700	5.7							5500			
7.	Willow Spr.	5000	5.0								5000		
8.	Hitt Spr.	7000	7.0									5000	2000
9.	Tule	5500	5.5										3000
10.	Pine Cr.	3100	3.0										
11.	Hearst	2000	2.0										
12.	McClellan	2000	2.0										
		57700	58.2	2000	5000	5000	5000	5500	5500	5500	5000	5000	5000
Tusayan - Tusayan Blk.													
1.	Peterson	3000	3.0	2500									
2.	Hull	6000	6.0		2000	3000	1000						
3.	Coco. Wash.	3000	3.0				1500	1500					

Table #7 (continued)

CUTTING BUDGET - PLANNED

Districts - Sale — Commercial Forest Land - Acres and Volume to be Cut

Tusayan - Tusayan Blk.	Acres	MM Bd.ft	Fiscal Year: Mbf. 1963	Mbf. 1964	Mbf. 1965	Mbf. 1966	Mbf. 1967	Mbf. 1968	Mbf. 1969	Mbf. 1970	Mbf. 1971	Mbf. 1972
4. Coco. Basin	5000	5.0					1000	2500	1500			
5. Skinner	8500	8.5							1000	2500	2500	2500
	25500	25.5	2500	2000	3000	2500	2500	2500	2500	2500	2500	2500
			12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000

-19b-

Table 8. Pulpwood Cutting Budget

(This will be completed as information becomes available)

VII. TIMBER DISPOSAL POLICIES

A. Sales

The size and location of sales of green timber will be made in accordance with the provisions of the cutting budget and will be correlated with the needs of the established mills dependent upon the Working Circle for their raw material supply.

B. Point of Manufacture

No requirements as to point of manufacture is deemed necessary or desirable in the sale of National Forest timber from this Working Circle.

C. Utilization Standards

It may be desirable to utilize less than 12" DBH stems in the large pole size class for sawlogs on the Williams Working Circle. The proposed installation of a gang saw to handle small logs should be reason for providing utilization to a minimum diameter of 9" for sawlogs. Thinning in large pole stands for spacing and increased yield is therefore made possible on a commercial thinning basis.

VIII. FOREST DEVELOPMENT

A. Transportation

A transportation plan has been prepared for each District and is on file at each District Ranger's office. A transportation map is included in the Appendix. The following is a listing of road needs for the next 10-year period: Table 9, pages 22a through c

Table #9

TABULAR LIST OF ROAD NEEDS - 2/1/62 * TARP roads

District Adv.

Map No.	Date	Sale Name		Road No.	Number Miles		Complete Survey	Complete Road	Costs TARP
Chalender 1.	4/1/62	Dog Town	FY 62	7140*	3.5	R	2/1/62*	2/1/62	$4,000
		Dog Town	FY 63	7140*	2.0	R	2/1/62*	6/30/62	2,000
		So. Sitgr.	FY 63	776A*	1.2	C	2/1/62*	8/31/62	4,500
Chalender 2.	8/1/62			776A	2.0	C	2/1/62	Out	5,000
				775	1.0	R	2/1/62		
				774	.2	R	2/1/62		
				776	1.4	R	2/1/62		
				775B	1.5	R	2/1/62		
				775A	2.6	R	2/1/62		
				7116		Mtc	2/1/62*	Force Acct R&Mtc	1,600
Tusayan	8/31/62	Peterson	FY 63	7320*	1.8	R	2/1/62*	Babbitt to Govt Tank	3,000
				7320*	2.7	C	2/1/62	Extend Exist. 9/30/62	5,000
				7311	4.2	R			
				7316	2.1	R	2/1/62		
Williams 1.	9/30/62	Pozzoulana	FY 63	7137	3.0	C	9/1/62	6/30/63	
			FY 64	Spr.Rds		C	9/1/62		
- -	4/30/62	Volunteer	FY 64	724	2.0	R			
				764	1.0	R	6/30/63		
Chalender				765	1.0	R			
Tusayan 2.	9/1/63	Hull	FY 64	7302*	3.0	R	*12/31/62	9/30/63	8,000
				7307	2.0	R	12/31/62		
Chalender 4.	4/30/64	No. Sitgr.	FY 65	7133	3.0	C&R	6/30/63*	6/30/64	8,000
				7133A	1.0	C&R	6/30/63*	12/31/64	
				797A	1.0	"	6/30/63		
Williams 2.	7/1/64	Bixler	FY 65	745	2.0	R	4/30/64	9/30/64	
Chalender 5.	8/31/64	Rosilda	FY 65	7139*	7.0	C	12/31/63*	10/31/64*	7,000
				7748	1.5	C	10/31/64		
				7749	2.0	C	10/31/64		
				748	2.0	C	10/31/64		

Table #9 (continued)

TABULAR LIST OF ROAD NEEDS - 2/1/62 * TARP roads

District Adv.

Map No.	Date	Sale Name		Road No.	Number Miles		Complete Survey	Complete Road	Costs TARP
				748	2.0	C	10/31/64		
				7747.1	1.0	C	10/31/64		
				Power					
				Line	5.0	C	10/31/64		
Williams 3.	7/1/65	Andrews Spr.	FY 66	7122	4.0*	R&C	8/31/64*	7/1/65	5,000
				7122A	2.0	C			
Tusayan 3.	7/1/65	Coco. Wash	FY 66 & 67	7605	1.0*	C	9/30/64*	7/1/65	2,000
Chalender 6.	7/1/67	KA Hill		759	2.5	R	12/31/67		
					1.5	C	12/31/67		
				713	3.5	R	12/31/67		
				7109	2.5*	R	9/30/63*	9/30/64	7,500
				718	1.5	R	12/31/67		
				KA Hill	1.0	C	12/31/67		
		(Ros. Spr. S.		Rge.line	2.0	C	12/31/67		
Chalender 7.	9/30/68	Chalender		725.2	1.0	R			
				Rge.line	1.5	R			
				766D	2.0	R			
Chalender 8.	9/30/69	Pipelines		776C	2.0	R			
				776D	1.0	R			
				758	2.5	R			
				716A	3.0	R			
Williams 4.	7/1/66	Bear Spr.		746	3.0	R	9/30/64*	6/30/65	7,000
				757A	3.5*	R	9/30/64*	6/30/65	
Williams 5.	7/1/67	Lockett		None		R			
Williams 6.	7/1/68	Adams		7108A	4.5	R	6/30/67	12/31/67	
Tusayan 4.	9/30/66	Coconino Basin		None					

Table #9 (continued)

TABULAR LIST OF ROAD NEEDS - 2/1/62 * TARP roads

District Adv.

Map No.	Date	Sale Name	Road No.	No. Miles		Complete Survey	Complete Road	
Tusayan 5.	7/1/68	Skinner	7302 Twn: None Tk.:	10.0*	R	9/30/66	9/30/67	10,000
Williams 7.	7/1/69	Willow	7109	1.5	R	9/30/63	9/30/64	4,500
			713	1.0	R	6/30/68	12/31/68	
Wms. 8	7/1/70	Hitt	None					
Chal. 9	8/1/71	Govt. Mtn.	None					
Wms. 9	7/1/71	Tule	None					

B. Reforestation

Reforestation plans have been prepared. Acreages and areas of priority are included. Projects will be started immediately following all fires 10 acres and larger to establish reproduction on the denuded area. Site preparation will precede all direct seeding and planting projects as needed. The following is the planting and seeding program for the 10-year period.

Table 10

Planting and Seeding Program
Williams Working Circle FY 1963 - FY 1972

Field Planting (M. Trees)

FY's	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972
P&M	5.5	2.5	2.5	5.0	5.0	5.0	5.0	10.0	10.0	10.0
KV	0	0	0	0	0	0	0	0	0	0
Total=	5.5	2.5	2.5	5.0	5.0	5.0	5.0	10.0	10.0	10.0

Direct Seeding (Acres)

P&M	2,800	9,765	14,600	5,000	Same for balance of years.		
KV	350	320	0	300	Same for balance of years.		
Total	3,150	10,085	14,600	5,300	5,300	5,300	Same balance to 1972.

C. Timber Stand Improvement

Timber stand improvement plans are kept by each District Ranger. These plans include pruning, thinning, dwarfmistletoe control, and removal of weed species; and the application of each. The removal of excess basal area from pulpwood stands will greatly reduce the presence of dwarfmistletoe. The following is the 10-year thinning program.

Table 11

Timber Stand Improvement
Williams Working Circle

Pre-Commercial Thinning (Acres)

FY's	63	64	65	66	67	68	69	70	71	72
P&M	350	4,230	4,430	4,000	4,000	4,000	4,000	4,000	4,000	4,000
KV	710	375	610	600	600	600	600	600	600	600
Total	1,060	4,605	5,040	4,600	4,600	4,600	4,600	4,600	4,600	4,600

Dwarfmistletoe control acres are included in the above figures.

Present plans call for a very limited pruning program and then only on the very best of sites.

Pruning (Acres)

FY's	63	64	65	66	67	68	69	70	71	72
P&M	125	125	125	125	125	125	125	125	125	125
KV	25	25	25	25	25	25	25	25	25	25
Total	150	150	150	150	150	150	150	150	150	150

Other stand improvement will be accomplished with the pulpwood sale operation. Roughly 20,000 cords per annum will be cut on the Working Circle which will approximate 3,500 acres annually. Some precommercial size stems may have to be removed following this cut, but at present we will have to wait cutting to determine necessity.

Where invasion of alligator juniper prevails in fringe stands, direct control measures will be done as part of the timber stand improvement program.

D. Fire Control

Timber management objectives can be met if the burned area can be confined to the par of 120 acres/amn.

A fire plan, in accordance with regional standards, will be prepared for each advertised sale area and will be revised and reviewed with the timber operator by the forest officer in charge of the sale, annually, to assure compliance with the sale contract and fire plan provisions.

A 10-year fire record is in the Appendix.

The standards for treatment of slash should be outlined in the pre-sale prescriptions and should be based on obtaining the most fire and soil protection for funds available while meeting the objectives of forest management and other land uses. Standards should vary with forest types, cutting practices, soil type, size of areas, risk, fuels, topography, values, availability of protection funds, possibility of intensive protection versus complete disposal, accessibility, and the many other factors affecting protection and land use.

E. Rodent Control

Rodent control will be applied on plantations, direct seeding projects and other areas where evidence shows the need.

F. Animal Control

Animal control will be applied to each area to be regenerated and continued until such time that the young trees are past the danger of browse damage from animals. If the animals cannot be deferred by other methods, the areas will be fenced. Wildlife damage will be reported to the Forest Supervisor who will work with the State Game and Fish Department to establish damage prevention measures. Measures can include exclusion of wildlife by fencing or by using repellents, and control of numbers by special hunts or manipulation of the habitat.

End, Action Plan Section
of
1962 Timber Management Plan
Williams Working Circle
Kaibab National Forest

End, Action Plan Section

of

1962 Timber Management Plan

Williams Working Circle

Kaibab National Forest

IX. INSECT AND DISEASE CONTROL

A. General Conditions

The endemic nature of the Dendroctonus ponderosa pine bark beetles, the fir engraver beetle, and ips present no special problems currently on this Working Circle.

B. Special Problems

1. Diseases

Dwarfmistletoe (Arceuthobium vaginatum). Dwarfmistletoe is the most important disease on this Working Circle. Until recently, little was known as to the area occupied or threatened. The recent pulpwood survey provided a means of indicating whether dwarfmistletoe was present on the plots examined. A rough check on plots having dwarfmistletoe indicates that about 8% of the area has dwarfmistletoe. These plots are being kept on a map and with compartment examination, areas of infection can be located and treated. The only known method of removal is by cutting infected trees. For this cutting period, marking guides, and thinning guides should provide for removing the infected trees from the overstory in age classes over rotation age. In other stands, the stand should be cleaned as far as possible but the basal area should not be reduced below 30% of optimum basal area for the site. In areas to be planted, infected trees should be removed to more than forty feet around the outside edge of the plantation. After more knowledge is gained, dwarfmistletoe stands may be given first priority for regeneration as the majority of the stands become merchantable.

2. Tree Killing Bark Beetles

Douglas-fir beetle (Dendroctonus pseudotsugae) The Douglas-fir bark beetle epidemic on Bill Williams Mountain can be controlled materially by logging insect infested Douglas-fir together with overmature and decadent white fir, Douglas-fir, and ponderosa pine. Decadent, overmature virgin timber stands harbor insects and disease. This is an important watershed area for the Town of Williams. Carefully supervised timber harvest will not impair the watershed values.

C. Handling Abnormal Conditions

As cutting is accelerated in young stands, constant surveillance will be maintained and appropriate modification of cutting plans and debris disposal will be made or direct control action will be taken as needed. Rangers and all other personnel on the South Kaibab Division of the forest will be alert in the reporting and handling of new epidemic outbreaks. All personnel on aerial fire patrols will be continually on the alert to detect and report signs of epidemic outbreaks. Epidemic outbreaks, once reported and handled, will be under continual inspection until control is assured. Regional help will be solicited on outbreaks.

X. APPENDIX - Index

		Page No.
A.	REFERENCES	29, 30
B.	STATISTICS OF INVENTORY	31
C.	TIMBER DATA	32
	Table 12. Gross Land Ownership	33
	Table 13. Classification of Land Area	34
	Table 14. Classification of Commercial Forest Lands & General Condition Classes	35
	Table 15. Net Volume by Species - All Lands	36
	Table 16. Net Volume by Species - Nat'l. Forest	37
	Table 17. Net Volume by Sawtimber Types - All Lands	38
	Table 18. Net Volume by Sawtimber Types - National Forest	39
	Table 19. Gross Volume per Acre by Species, Types and Density Classes	40
	Table 20. Defect Factors	41
D.	GROWTH CALCULATIONS	42
	1. Southwestern Ponderosa Pine Formulae	42, 43
	2. Calculation of Probable Growth for Working Circle Using Site Indices	44
	3. Allowable Cut Calculations	44
E.	STAND TABLES	44
	P1-C	44a
	Total Volume Plot Summary - By Types	44b thru 48
F.	RECORDS	
	1. Record of Cutting 1949-1955, Inclusive	49
	2. Record of Cutting 1956-1961, Inclusive	50
	3. Fire Record 1953-1961, Inclusive	52
	4. Compartment Examination Budget	53, 54
	5. Record of Sawtimber and Area Cut	55
G.	MAPS	Separate Binder
	1. Sale and Transportation Map	
	2. Thinning Map	
	3. Planting and Seeding Map	
	4. Compartment Map (When Compartment Field Work is completed).	

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12. Forbes, Reginald D., Forestry Handbook. New York, the Ronald Press Company, 1955. (Sections 6-56 to 6-63).

B - STATISTICAL ANALYSIS OF 1955 PLOT INVENTORY DATA

Number of Sample Plots - $N = 425$

Sum of Plot Volumes - $\Sigma x = 32,625$

Sum of Squared Plot Volumes - $\Sigma x^2 = 6,394,010$

Mean (average) volume per plot - $\bar{x} = \frac{\Sigma x}{N} = 76.765$

Standard Deviation From Mean - $Sx = \frac{1}{N} \sqrt{N(\Sigma x^2) - (\Sigma x)^2} = 95.668$

Standard Error of Mean - $\bar{S}x = \frac{Sx}{\sqrt{N}} = 4.641$

Coefficient of Variation - $C = \frac{Sx(100)}{\bar{x}} = 124.624$

Percent of Error - $A = \frac{\bar{S}x(100)}{\bar{x}} = 6.046$

Total number of plots required for 5% accuracy (two times out of three).
A = desired % of accuracy

$$N = \frac{C^2}{A^2} = \frac{15,531.141}{25} = 621.246 = 622$$

C. TIMBER DATA

Tables 12 through 20 on pages 33 to 41

TABLE 12
GROSS LAND OWNERSHIP (ACRES)

WILLIAMS WORKING CIRCLE

Block	Gross Area	State Land			Private Land				National Forest		
		Commercial	Others	Total	Commercial	Others	Total	Commercial	Others	Total
Williams	312,299	575	65	640	11,277	21,200	32,477	217,388.5	61,793.5	279,182
Tusayan	109,128	-	-	-	538.5	572.5	1,111	81,094.5	26,922.5	108,017
Total	421,427	575	65	640	11,815.5	21,722.5	33,588	298,483	88,716	387,199

Commercial - P1-, P2-, PNS, etc.

Other - PJ, N

TABLE 13

CLASSIFICATION OF LAND AREA (ACRES)

WILLIAMS WORKING CIRCLE

Ownership	Net Area	Commercial Timberlands* Sawtimber	Aspen	Inaccessible	Administrative Areas	Woodland PJ	Woodland N
Nat'l. Forest	387,199	298,158	325	5,220	160	53,085.5	30,250.5
State	640	575.0	-	-	-	-	- 65
*Private	33,588	11815.	-	-	-	867.5	20,905.5
Total	421,427	310,548	325	5,220	160	53,953.0	51,221.0
						105,174	

* Commercial timberlands include:

P1	MC1
P2	MC2
P3	MC3
PNS	

TABLE 14

CLASSIFICATION OF COMMERCIAL FOREST LANDS (SAWTIMBER) BY TYPES AND GENERAL CONDITION CLASSES (ACRES). INACCESSIBLE NOT INCLUDED

WILLIAMS WORKING CIRCLE

Ownership	Condition Classes	Ponderosa Pine	Mixed Conifer	Total Sawtimber Types	Aspen
Nat'l. Forest	Virgin	20,786	2182.0	22,968	325
	Cutover	274,798	392.5	275,190.5	-
State	Virgin	-	-	-	-
	Cutover	575	-	575	-
Private	Virgin	194.5	-	194.5	-
	Cutover	11,621	-	11,621	-

TABLE 15

(NET) VOLUME BY SPECIES - NATIONAL FOREST, STATE, AND PRIVATE COMMERCIAL FOREST LANDS

Mbf - Scribner - Stems 11.6" DBH and Over

	Condition Class	Ponderosa Pine	Douglas-Fir	True Fir	Limber Pine	Spruce	Grand Total	Cu. Ft. Aspen
Nat'l. Forest	Virgin	58,881	7,299	574	1,320	122	68,196	45,143
	Cutover	646,607	579	21	166	13	647,386	-
	Total	705,488	7,878	595	1,486	135	715,582	45,143
State	Virgin	-	-	-	-	-	-	-
	Cutover	1,380	-	-	-	-	1,380	-
	Total	1,380	-	-	-	-	1,380	-
Private	Virgin	698	266	-	3	-	967	10,070
	Cutover	17,455	-	-	-	-	17,455	-
	Total	18,153	266	-	3	-	18,422	10,070

TABLE 16

(NET) VOLUME BY SPECIES - NATIONAL FOREST ONLY

COMMERCIAL FOREST LANDS

Mbf - Scribner - Stems 11.6" DBH and Over

Block	Condition Classes	Ponderosa Pine	Douglas-Fir	True Fir	Limber Pine	Spruce	Grand Total	Aspen Cu. Ft.
Williams	Virgin	31,217	7,299	574	1,320	122	40,532	45,143
	Cutover	459,443	579	21	166	13	460,222	-
	Total	490,660	7,878	595	1,486	135	500,754	45,143
Tusayan	Virgin	27,664	-	-	-	-	27,664	-
	Cutover	187,164	-	-	-	-	187,164	-
	Total	214,828	-	-	-	-	214,828	-
Working Circle	Virgin	58,881	7,299	574	1,320	122	68,196	45,143
	Cutover	646,607	579	21	166	13	647,386	-
	Total	705,488	7,878	595	1,486	135	715,582	45,143

TABLE 17

NET VOLUME BY SAWTIMBER TYPES

NATIONAL FOREST, STATE AND PRIVATE

Mbf - Scribner - Stems 11.6" DBH and Over

Ownership	Type	Commercially Operable	Inaccessible	Administrative Areas	Total
National Forest	Ponderosa Pine	704,946	10,894	45	715,885
	Mixed Conifer	10,636	10,872	270	21,778
	Total	715,582	21,766	315	737,663
State	Ponderosa Pine	1,380	-	-	1,380
	Mixed Conifer	-	-	-	-
	Total	1,380	-	-	1,380
Private	Ponderosa Pine	18,422	-	-	18,422
	Mixed Conifer	-	-	-	-
	Total	18,422	-	-	18,422

TABLE 18

NET VOLUME BY SAWTIMBER TYPES - NATIONAL FOREST ONLY

COMMERCIAL FOREST LAND - WILLIAMS WORKING CIRCLE

Mbf - Scribner - Stems 11.6" and over

Block	Type	Commercially Operable	Inaccessible	Administrative Areas	Total
Williams	Ponderosa Pine	489,000	10,894	45	499,939
	Mixed Conifer	10,636	10,872	270	21,778
	Total	499,636	21,766	315	521,717
Tusayan	Ponderosa Pine	215,946	-	-	215,946
	Mixed Conifer	-	-	-	-
	Total	215,946	-	-	215,946

TABLE 19

GROSS VOLUME PER ACRE BY SPECIES, TYPES, AND DENSITY CLASSES

Virgin and Cutover — Williams Working Circle

Sawtimber (11.6" DBH and Over)

Bd. Ft. Scribner

Species	Ponderosa Pine Type						Mixed Conifer Type				Aspen
	P1-	P2=	P2-	P3-	P3=	PNS	MC1-	MC1=	MC1=		
Ponderosa Pine	341.6	155.3	86.13	15.0	135.2	7.26	340.00	344.8	326.0		18.0
Douglas Fir							420.00	449.6	138.0		72.0
White Fir											
Cork B. Fir							129.33				
Limber Pine							6.00	175.2			7.0
Spruce								12.5			
Aspen											(138.9 Cu.Ft.)
Total	341.6	155.3	86.13	15.0	135.2	7.26	895.33	982.1	464.0		97.0

P1- P1= P1-V P1=V

MC1- MC1-V

MC1= MC1=V

MC1= MC1=V

No merchantable volume in MC2
MC3

TABLE 20

APPENDIX

Defect Factors Used to Reduce
Inventory Volumes from Gross to Net

Species	Virgin	Cutover
Ponderosa pine	25	15
Douglas-fir	20	10
True Fir	40	20
Limber Pine	40	20
Spruce	20	10

D. GROWTH CALCULATIONS

1. Southwestern Ponderosa Pine Formulae

GROWTH CALCULATIONS
Ponderosa Pine and Mixed Conifer Types

(Cutover)

Timber Management Handbook, page II-2-8, for formulae.

Net annual growth = Gross growth of original sawtimber trees + ingrowth into sawtimber size - mortality of sawtimber trees.

a. Gross Growth

Gross increment of original trees (those over 11.5" D.B.H. at time of Inventory) is estimated from the formula:
Log gross growth = 1.9385 - .5815 (Logarithm reserve volume) plus 1.4366 (Logarithm reserve basal area)

Reserve volume per acre (derived from the 1955 Timber Inventory) ---------- 2,797 BM

Gross reserve basal area ---------- 23.916 swuare feet per acre

Log gross growth = 1.9385 - .5815 (Logarithm 2,797), plus 1.4366 (Logarithm 23.916)
1.9385 - 2.00425 + 1.98063 = 1.91488

Antilog: 1.91488 = 82.20 bd. ft. per acre per year.

b. Ingrowth

Log ingrowth = 0.8601 - .2342 (Logarithm reserve number of trees 11.6" d.b.h. and up) + .6858 (Logarithm reserve number of trees 7.6" to 11.5" d.b.h.)

0.8601 - .2342 (Logarithm of 10.945) + .6858 (Logarithm 11.18 poles)

0.8601 - .2342 (1.0392) + .6858 (1.0494)

0.8601 - .2434 + .7190 =

1.3357

Antilog: 1.3357 = 21.66 bd. ft. per acre per year.

c. Mortality

$$\text{Mortality} = \sqrt{3.4142 + .0151\,(\text{reserve volume}) - 1.2156\,(\text{reserve basal area})} + 3$$

$$\sqrt{3.4142 + .0151\,(2{,}797) - 1.2156\,(23.916)} + 3$$

$$\frac{3.4142 + 42.2347 - 29.0723}{3}$$

$$\frac{16.58}{3} = 5.53 \text{ bd. ft. per acre per year.}$$

d. Net Annual Growth

Gross growth	82.20	bd. ft. per acre per year
Ingrowth	+ 21.66	bd. ft. per acre per year
Total growth	103.86	
Mortality	- 5.53	
Net gross growth	98.33	
	- 9.83	(Reduce 10% for increase in interior defect, breakage, etc.)
Net available annual growth per acre per year	88.50	

2. Calculation of Probable Growth for Working Circle

Using Site Indices

The Working Circle has not, to date, been typed by site index. Some site indices have been recorded and an average of S.I. 65 was used in the Growth Calculations for ponderosa pine and S.I. 85 was used for mixed-conifer type. This plan will be adjusted when more complete information is available.

Table 25, page 36 from Technical Bulletin No. 630 gives the mean annual board-foot increment Scribner Rule, per acre of trees 11.6" and more in diameter. (a) For ponderosa pine Site Index 65 at 110 years, the increment per acre is 121.

Total commercial acres 295,584 x 121 bd. ft./acre = 35,765,664 bd. ft./acre/year. (b) For mixed-conifer type Site Index 85 was used. Table 4 Technical Bulletin No. 201 - Yield tables for Douglas-fir on fully stocked acre, trees 12 inches in diameter and larger was used.

Site Index 85 shows 140 bd. ft./acre/year at 110 years.
140 x total acres of mixed-conifer gives potential mean annual growth.
140 x 2,574.5 = 360,430 bd. ft.

Ponderosa pine - 35,765,664 Mbf
Mixed-conifer - 360,430 Mbf
Total, W.C. - 36,126,094 Mbf Scribner

3. Allowable Cut Calculations

Actual cutting records for the cutover lands for sales from 1956 through 1961 show that a net cut of 1,000 bd. ft. Scribner is average. There are approximately 174,000 acres supporting this cut volume remaining in the Working Circle to be cut during the 14.5 years left in this cutting period. This sets up a minimum 12,000 Mbf Scribner to be cut annually.

45,317 Mbf Scribner were cut in the first six years of this cutting period. Therefore, a total of 219,317 Mbf Scribner will be cut. This is 31% of the 1955 standing inventory and 45.5% of the periodic annual growth.

Pulpwood inventory, annual cut, and cutting budget will be appended when prepared.

E. STAND TABLES

Table 21, Page 44a

Table 22, Pages 44b through 44h

TABLE 21

STAND TABLE - CUTOVER

Pl-C Type

Kaibab N.F. Williams W.C. Based on 425 Plots

Stems per acre by 1" Diameter Classes

D.B.H. Inches	PP* No.	BJ No.	DF No.	True Firs No.	S No.	All Species No.	BA Factor	Basal Area
4	18.8						.087	1.636
5	16.9						.136	2.298
6	12.9						.196	2.528
7	10.3						.267	2.750
Subtotal	58.9							9.212
8	7.7						.349	2.687
9	6.2						.442	2.740
10	4.5						.545	2.452
11	3.6						.660	2.376
Subtotal	22.0							10.255
12	2.756						.785	2.163
13	2.231						.922	2.057
14	1.878						1.069	2.008
15	1.500						1.227	1.841
16	1.317						1.396	1.839
17	1.010						1.576	1.592
18	1.170						1.767	2.067
19	1.097						1.969	2.160
20	1.024						2.182	2.234
Subtotal	13.983							17.961
21	0.915						2.405	2.201
22	.622						2.640	1.642
23	.646						2.885	1.864
24	.549						3.142	1.725
25	.402						3.409	1.370
26	.341						3.687	1.257
27	.317						3.976	1.260
28	.109						4.276	.466
29	.109						4.587	.500
30	.122						4.909	.599
31	.109						5.241	.571
32	.097						5.585	.542
33	.024						5.940	.143
34	.061						6.305	.385
35	.012						6.681	.080
36	.024						7.069	.170
37	.024						7.467	.179
40	.012						8.727	.105
Subtotal	4.495							15.059
TOTAL	99.378							52.487

*Includes Arizona, Apache & Chihuahua Pines

TABLE 22

TOTAL VOLUME PLOT SUMMARY - BY TYPES

Kaibab National Forest — Williams Working Circle

Forest Type: Pl- — Date: 1955

Plot No.	Gross Volumes - Board Feet Scribner Decimal C Scale					Total Gross Volumes
	PP	LP	DF	Spruce	CBF	
W - 4	56					56
5	14					14
8	16					16
11	108					108
13	261					261
15	118					118
17	144					144
18	217					217
22	66					66
23	24					24
27	102					102
30	71					71
32	49					49
33	-					-
34	8					8
35	212					212
38	12					12
41	55					55
43	42					42
44	77					77
45	4					4
46	177					177
47	127					127
50	5					5
51	82					82
52	-					-
53	125					125
58	306					306
61	100					100
62	32					32
63	-					-
64	27					27
65	20					20
67	42					42
68	214					214
69	-					-
71	683					683
76	-					-
79	22					22
80	4					4
81	253					253

TOTAL VOLUME PLOT SUMMARY - BY TYPES (CONTD.)

Forest Type P1-

Plot No.	Gross Volumes - Board Feet Scribner Decimal C Scale					Total Gross Volumes
	PP	LP	DF	Spruce	CBF	
W - 82	-					-
83	2					2
84	20					20
87	198					198
88	67					67
89	8					8
92	163					163
94	39					39
95	34					34
96	33					33
97	20					20
98	145					145
99	231					231
100	12					12
101	-					-
103	138					138
104	40					40
108	34					34
109	28					28
110	12					12
111	93					93
113	24					24
117	114					114
118	180					180
120	-					-
121	131					131
122	-					-
123	172					172
124	256					256
125	123					123
127	18					18
129	147					147
130	13					13
131	49					49
133	53					53
134	63					63
135	10					10
138	80					80
140	86					86
141	50					50
142	110					110
145	240					240
148	25					25
149	12					12
151	7					7

TOTAL VOLUME PLOT SUMMARY - BY TYPES (CONTD.)

Forest Type - Pl-

Plot No.	Gross Volumes - Board Feet Scribner Decimal C Scale					Total Gross Volumes
	PP	LP	DF	Spruce	CBF	
W-152	158					158
155	68					68
157	75					75
159	33					33
161	92					92
162	113					113
165	8					8
166	103					103
169	20					20
173	147					147
174	97					97
175	12					12
179	42					42
181	36					36
183	-					-
187	55					55
188	19					19
191	-					-
192	83					83
194	72					72
195	498					498
196	56					56
199	40					40
203	115					115
204	74					74
206	51					51
208	56					56
209	112					112
200	171					171
210	66					66
211	148					148
215	19					19
218	201					201
219	86					86
220	65					65
221	204					204
223	91					91
227	16					16
228	123					123
231	6					6
233	7					7
234	63					63
235	152					152

TOTAL VOLUME PLOT SUMMARY - BY TYPES (CONTD.)

Forest Type - Pl-

Plot No.	Gross Volumes - Board Feet Scribner Decimal C Scale					Total Gross Volumes
	PP	LP	DF	SPRUCE	CBF	
W-236	44					44
238	27					27
239	81					81
240	149					149
241	-					-
243	82					82
244	17					17
245	91					91
247	5					5
248	22					22
250	154					154
251	29					29
252	294					294
254	115					115
255	68					68
256	135					135
257	182					182
259	16					16
260	100					100
261	-					-0-
262	62					62
263	-					-0-
266	207					207
267	20					20
269	20					20
277	5					5
278	46					46
281	85					85
282	226					226
283	-					-0-
284	44					44
286	6					6
288	49					49
289	202					202
290	51					51
291	43					43
292	32					32
294	22					22
295	102					102
296	68					68
297	-					-0-
299	48					48
300	115					115

TOTAL VOLUME PLOT SUMMARY - BY TYPES (CONTD.)

Forest Type - Pl-

Plot No.	Gross Volumes - Board Feet Scribner Decimal C Scale				Total Gross Volumes
	PP	LP	DF	Spruce	
W-302	-				-
304	265				265
306	-				-
308	52				52
309	84				84
310	122				122
313	-				-
314	116				116
315	24				24
321	126				126
324	54				54
325	154				154
326	100				100
327	52				52
328	-				-
332	462				462
333	197				197
336	61				61
337	7				7
338	68				68
340	25				25
341	66				66
344	78				78
345	14				14
348	147				147
349	83				83
350	146				146
354	-				-
355	105				105
357	101				101
358	225				225
359	33				33
360	112				112
361	615				615
362	286				286
367	103				103
368	-				-
369	277				277
372	125				125
374	11				11
375	4				4
376	359				359
377	88				88
378	96				96
379	114				114

TOTAL VOLUME PLOT SUMMARY - BY TYPES (CONTD.)

Forest Type - Pl-

Plot No.	Gross Volumes - Board Feet Scribner Decimal C Scale					Total Gross Volumes
	PP	LP	DF	SPRUCE	CBF	
W-380	-					-
381	127					127
382	-					-
383	4					4
384	49					49
385	267					267
386	144					144
388	50					50
390	59					59
391	426					426
392	117					117
393	73					73
394	153					153
396	253					253
399	64					64
401	128					128
404	76					76
405	31					31
407	-					-
410	199					199
411	11					11
412	64					64
415	87					87
416	121					121
417	2					2
418	41					41
420	307					307
421	17					17
422	67					67
423	27					27
424	171					171
426	-					-
428	340					340
430	38					38
432	-					-
431	41					41
433	15					15
434	11					11
435	32					32
436	54					54
437	11					11
438	86					86
439	230					230
441	68					68

TOTAL VOLUME PLOT SUMMARY - BY TYPES (CONTD.)

Forest Type - Pl-

Plot No.	Gross Volumes - Board Feet Scribner Decimal C Scale					Total Gross Volumes
	PP	LP	DF	SPRUCE	CBF	
W-444	39					39
445	35					35
447	9					9
448	18					18
449	189					189
455	48					48
456	170					170
457	40					40
458	58					58
461	64					64
462	164					164
463	52					52
466	15					15
465	5					5
467	7					7
468	34					34
471	33					33
473	-					-
474	49					49
475	212					212
476	104					104
477	72					72
478	21					21
479	41					41
480	463					463
482	32					32
485	91					91
486	-					-
488	94					94
489	-					-
490	102					102
491	131					131
492	165					165
493	12					12
494	-					-
495	76					76
496	182					182
497	93					93
498	89					89
500	23					23
501	86					86
502	32					32
505	33					33

TOTAL VOLUME PLOT SUMMARY - BY TYPES (CONTD.)

Forest Type - Pl-

Plot No.	Gross Volumes - Board Feet Scribner Decimal C Scale					Total Gross Volumes
	PP	LP	DF	SPRUCE	CBF	
W-506	67					67
507	60					60
508	34					34
509	74					74
511	136					136
514	150					150
513	126					126
515	86					86
517	147					147
519	9					9
520	8					8
521	16					16
523	54					54
524	165					165
525	36					36
526	2					2

Forest Type - Pl-V

W- 20	38					38
225	157					157
366	134					134
406	90					90
409	17					17
413	44					44
484	69					69
516	16					16

Forest Type - MCl-

W-132	101		375			476
83	42					42
293			153		117	270
331	40	9	43			92
352	245		49			294
365	82		10		77	169

TOTAL VOLUME PLOT SUMMARY - BY TYPES (CONTD.)

Forest Type - P3-

Plot No.	Gross Volumes - Board Feet Scribner Decimal C Scale					Total Gross Volumes
	PP	LP	DF	SPRUCE	CBF	
W- 3	20					20
19	-					-
150	2					2
246	-					-
270	-					-
356	6					6
450	-					-
487	2					2

Forest Types - P3= and P3≡

W-224	26					26
372	-					-
339	71					71
334	68					68
298	4					4

Forest Type - MC1=

W-114		131	15	47		193
440	92		138			230
499		88	73			161
518	334		148			472
528	5		188			193

Forest Type - MC1=

W-276	268					268
442			41			41
469	58		97			155
77	-		-			-

Forest Type - PNS

W- 2	-					-
12	-					-
16	-					-
25	15					15
31	-					-

TOTAL VOLUME PLOT SUMMARY - BY TYPES (CONTD.)

Forest Type - PNS

Plot No.	Gross Volumes - Board Feet Scribner Decimal C Scale					Total Gross Volumes
	PP	LP	DF	SPRUCE	CBF	
W- 36	-					-
42	-					-
49	16					16
66	-					-
91	-					-
112	-					-
147	2					2
213	-					-
217	-					-
275	-					-
346	-					-
347	-					-
363	-					-
398	-					-
402	-					-
408	-					-
427	-					-
429	16					16
451	-					-
452	-					-
470	-					-
483	-					-

Forest Types - P2= and P2≡

W- 39	43					43
75	9					9
136	12					12
170	-					-
180	9					9
205	-					-
232	4					4
249	15					15
265	-					-
274	106					106
335	241					241
342	61					61
343	-					-
370	29					29
400	52					52
425	24					24
459	-					-
460	107					107
464	16					16

TOTAL VOLUME PLOT SUMMARY - BY TYPES (CONTD.)

Forest Types - P2≡ and P2=

PLOT NO.	Gross Volumes - Board Feet Scribner Decimal C Scale					Total Gross Volumes
	PP	LP	DF	SPRUCE	CBF	
W-472	61					61
503	18					18
504	73					73
522	13					13

Forest Type - P2-

W- 28	6					6
49	-					-
59	-					-
271	-					-
323	37					37
351	-					-
353	23					23
364	-					-
389	-					-
395	-					-
397	-					-
443	195					195
454	39					39
481	15					15
510	8					8

Forest Type - Aspen

W- 40	18					18
40A		7	4			11
40B			62			62
40C			6			6

F

6. RECORDS

TABLE 23

RECORD OF CUTTING 1949 - 1955 INCLUSIVE

Williams and Bull Basin Block		Tusayan Block		Working Circle	
Volume Mbf	Acres Cutover	Volume Mbf	Acres Cutover	Volume Mbf	Acres Cutover
21,895	16,809	11,603	8,807	32,498	25,616

TABLE 24

RECORD OF CUTTING - 1956 - 1961, INCLUSIVE

Year	Williams Block Volume Mbf	Williams Block Acres Cutover	Tusayan Block Volume Mbf	Tusayan Block Acres Cutover	Working Circle Current Volume Mbf	Working Circle Current Acres Cutover	Working Circle Cumulative Volume Mbf	Working Circle Cumulative Acres Cutover	Pulpwood Current Cords	Pulpwood Current Acres	Pulpwood Cumulative Cords	Pulpwood Cumulative Acres
1956	4962	3529	1533	1340	6495	4869	6495	4869				
1957	4365	2956	1777	1500	6142	4456	12637	9325				
1958	6764	5529	1579	1200	8343	6729	20980	16054				
1959	6479	3450	1629	1365	8108	4815	29088	20869				
1960	6366	9557	1713	2330	8079	11887	37167	32756				
1961	5266	11010	2884	2820	8150	13830	45317	46586				
1962												
1963												
1964												
1965												
1966												
1967												
1968												
1969												
1970												
1971												
1972												

Allowable Cut - Tusayan Block - 1700 M
Williams Block - 5500 M
Working Circle - 7200 M per year

TABLE 24a

CUTTING BUDGET

Actual Cut

1/1-6/30

Districts Sale Chalender			C.Y. 1956	1957	1958	1959	1960	1961	1962 Est.
Map Ref.	Wms. Blk.	MBM							
1.	Lost Spr.	3309	1.2	2.1					
2.	Juniper	3820			1.1	1.45	1.27		
3.	Hobble	1662					1.66		
4.	Dogtown	5000							3.0
Williams									
1.	Twin Spr.	3280	3.28						
2.	Rnd.Mtn.	15437		2.47	5.37	5.0	2.57		
3.	Sycamore	4000					.86	3.05	
4.	Cow (MC)	4000						2.21	3.0
Sub-Total			4.48	4.57	6.47	6.45	6.36	5.26	6.0
Tusayan									
Tusayan Blk.									
1.	Armstrong		1.53						
1a.	Mistletoe	150		.15					
2.	W.Buckler	1630		1.63					
3.	Russell	3200			1.58	1.63			
4.	Yount	4500					1.71	2.9	
5.	Coco. Basin	4000							
6.	Moqui								
Sub-Total			1.53	1.78	1.58	1.63	1.71	2.9	
Grand Total			6.01	6.35	8.05	8.08	8.07	8.16	6.0

WC

TABLE 25

FIRE STATUS IN WILLIAMS WORKING CIRCLE

Year	A	B	C	D	E	Lightning	MAN-CAUSED		
							Lumbering	All Other	Acres
1961	149	18	2	0	0	137	0	32	97.4
1960	155	19	1	0	0	137	1	37	58.6
1959	121	12	2	0	0	113	1	21	45.6
1958	97	15	0	0	0	96	1	15	22.3
1957	72	11	0	0	0	77	0	6	8.4
1956	120	24	0	0	0	116	2	26	37.7
1955	50	6	2	0	0	32	0	26	39.7
1954	80	11	2	0	0	77	0	16	24.6
1953	57	17	3	0	0	49	0	28	146.00
Total	901	133	12	0	0	834	5	207	490.3

TABLE 26

COMPARTMENT EXAMINATION BUDGET

To be furnished when completed.

COMPARTMENT DATA

The Working Circle will be divided into compartments as provided herein. Each compartment will be mapped by stand age, by stand condition, and by site index. Silvicultural prescriptions will be prepared for each compartment. In addition, growth data will be developed for each compartment, based on stand age, site index, and on stand stocking.

A compartment map on a 1" to the mile scale will be inserted in this plan upon completion of compartment survey. This has been held up pending receipt of our new aerial photos.

A 10-year schedule of examination will be prepared and inserted here.

RECORD OF SAWTIMBER AND AREAS CUT

Williams Working Circle

F.Y. 1963 to F.Y. 19__, Inclusive

Fiscal Year	Compartment No.	Area Set up for 0-20 Year Age Class	Reproduction Cuts			Intermediate Cuts			Unreg. Cuts		Total Cut		
			Area Acres	Volume Regulated		Area Acres	Volume Regulated		Mbf. Scribner	Mcf.	Area Acres	Volumes	
				Mbf. Scribner	Mcf.		Mbf. Scribner	Mcf.				Mbf. Scribner	Mcf.
19__	____												
	____												
	____												
19__	Total												
19__	Total												
	____												
	____												
19__	Total												
Cumulative Total													

G

H. MAPS - In separate binder - By Districts

1. Sale and Transportation Map

2. Thinning and Planting Map

3. Compartment Map

(To be appended when prepared)